

REMARKS

Claims 1-18, 20-29, 31-32, and 37 are all the claims pending in the application. Claims 19, 30, and 33-36 are canceled herein without prejudice or disclaimer. Claims 1, 6, 10, 24-28, and 37 are amended herein. No new matter is being added. Claims 1, 10 and 24-27 stand rejected upon informalities. Claims 1-37 stand rejected on prior art grounds. Applicants respectfully traverse the rejections based on the following discussion.

I. The 35 U.S.C. §112, First Paragraph, Rejection

Claims 1, 10, and 24-27 stand rejected under 35 U.S.C. §112, first paragraph, as failing to comply with the written description requirement. In particular, the Office Action suggests that the term “permanently adhered” constitutes the addition of new matter, which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventors(s), at the time the application was filed, had possession of the claimed invention. As such, Applicants have amended claims 1, 10, 24-28, and 37 to change “permanently adhered” to “affix(ed)”. The term “affixed” or “affixing” is used in the specification as originally filed (see for example, page 5, paragraph [0012], lines 13-17 of the specification as originally filed). In view of the foregoing, the Examiner is respectfully requested to reconsider and withdraw this rejection.

II. The Prior Art Rejections

Claims 1-5, 7-18, 20, 24-28, 31-32 and 37 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Mirkin (U.S. Patent Publication No. 2004/0131843), hereinafter referred to as

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"Mirkin (843)" and Mirkin (U.S. Publication No. 2002/0177143), hereinafter referred to as "Mirkin (143)", in view of Anstadt, et al. (U.S. Patent No. 6,361,161), hereinafter referred to as Anstadt. Claims 7-9 and 16-18 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Mirkin (843) and Mirkin (143), in further view of Mirkin (U.S. Publication No. 2002/0063212), hereinafter referred to as "Mirkin (212)". Claims 6, 19, 21-23 and 28-29 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Mirkin (843), Mirkin (143), Mirkin (212) and in further view of Colbert (U.S. Publication No. 2003/0106998). Claims 30-31 and 33-36 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Mirkin (843), Mirkin (143), Mirkin (212) and Colbert, in further view of Requicha (U.S. Patent No. 6,508,979).

However, amended independent claims 1, 10, 24-28, and 37 include features not taught, suggested, or rendered obvious by the prior art references of record. In particular, amended independent claim 1 now includes elements recited in previous dependent claims 6 (currently amended) and 30 (now canceled without prejudice or disclaimer), whereby amended independent claim 1 recites, in part, "wherein said tip is coated with an adhesion layer, wherein said adhesion layer is between said tip and said nanoparticles, and wherein said nanoparticles are generally spherical." Likewise, amended independent claim 10 now includes elements recited in previous dependent claims 19 and 30 (now canceled without prejudice or disclaimer), whereby amended independent claim 10 recites, in part, "coating said scanning probe microscope tip with an adhesion promoter ... wherein said nanoparticles are generally spherical."

Similarly, amended independent claim 24 now includes elements recited in previous dependent claims 19 and 30 (now canceled without prejudice or disclaimer), whereby amended independent claim 24 recites, in part, "coating said scanning probe microscope tip, with the

exception of an apex of said tip, with a sacrificial adhesion layer; depositing generally spherical nanoparticles over said tip....”

Likewise, amended independent claims 25-28 now includes elements recited in previous dependent claims 19 and 33-36 (now canceled without prejudice or disclaimer), whereby amended independent claims 25-28 generally include, “coating said scanning probe microscope tip with an adhesion promoter” and “generally spherical nanoparticles”. Additionally, amended independent claim 37 now includes elements recited in previous dependent claims 6 (currently amended) and 31 (now canceled without prejudice or disclaimer), whereby amended independent claim 37 generally include; “wherein said scanning probe microscope tip is coated with an adhesion layer, wherein said adhesion layer is between said tip and said nanoparticles” and “generally spherical nanoparticles”.

In view of the changes to the independent claims, one of ordinary skill in the art would have to combine five separate references: Mirkin (843), Mirkin (143), Anstadt, Colbert, and Requicha to try and teach, but failing nonetheless, the claimed invention. Clearly, this proposed combination of five separate references is evidence of unobviousness of the claimed invention. Additionally, page 4 of the Office Action suggests that Anstadt “discloses that, in many applications nanoparticles stick to surfaces where Vander Waals forces are sufficient for permanent adherence” (col. 5, lines 63-67 of Anstadt). However, Anstadt has nothing to do with scanning probe microscopy (SPM). Rather, Anstadt deals with nanoparticles being bound to each other by Vander Waals forces (see Abstract; col. 2, lines 22-32; col. 4, lines 23-33; col. 5, lines 30-62; and col. 8, lines 2-50 of Anstadt). Additionally, the only application mentioned in Anstadt deals with an image producing receiver having nanoparticles attached to it.

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However, nanoparticles have not been used in SPM before because there did not exist a good method for attaching nanoparticles to SPM tips. The claimed invention further includes an adhesion promoter (adhesion layer) to better affix the nanoparticles to the probe tip. Clearly, there is no teaching in Anstadt of using an adhesion promoter to facilitate the adherence of the nanoparticles to the respective surface. Additionally, the adhesive layer described in paragraph [0055] of Colbert relates to nanotube assemblies, which as further explained below, is a separate and wholly unique application the claimed invention's nanoparticle assemblies.

Insofar as references may be combined to teach a particular invention, and the proposed combination of Mirkin (843), Mirkin (143), Anstadt, Colbert, and Requicha in various combinations with one another, case law establishes that, before any prior-art references may be validly combined for use in a prior-art 35 U.S.C. § 103(a) rejection, the individual references themselves or corresponding prior art must suggest that they be combined.

For example, in In re Sernaker, 217 U.S.P.Q. 1, 6 (C.A.F.C. 1983), the court stated: "[P]rior art references in combination do not make an invention obvious unless something in the prior art references would suggest the advantage to be derived from combining their teachings." Furthermore, the court in Uniroyal, Inc. v. Rudkin-Wiley Corp., 5 U.S.P.Q.2d 1434 (C.A.F.C. 1988), stated, "[w]here prior-art references require selective combination by the court to render obvious a subsequent invention, there must be some reason for the combination other than the hindsight gleaned from the invention itself. . . . Something in the prior art must suggest the desirability and thus the obviousness of making the combination."

In the present application, the reason given to support the proposed combination is improper, and is not sufficient to selectively and gratuitously substitute parts of one reference for

a part of another reference in order to try to meet, but failing nonetheless, the Applicants' novel claimed invention. Furthermore, the claimed invention, as amended, meets the above-cited tests for obviousness by including embodiments such as having generally spherical nanoparticles affixed to the microscope tip and coating the microscope tip with an adhesion promoter prior to affixing the nanoparticles thereon. As such, all of the claims of this application are, therefore, clearly in condition for allowance, and it is respectfully requested that the Examiner pass these claims to allowance and issue.

As declared by the Federal Circuit:

In proceedings before the U.S. Patent and Trademark Office, the Examiner bears the burden of establishing a prima facie case of obviousness based upon the prior art. The Examiner can satisfy this burden only by showing some objective teaching in the prior art or that knowledge generally available to one of ordinary skill in the art would lead that individual to combine the relevant teachings of the references. In re Fritch, 23 U.S.P.Q.2d 1780, 1783 (Fed. Cir. 1992) citing In re Fine, 5 U.S.P.Q.2d 1596, 1598 (Fed. Cir. 1988).

Here, the Examiner has not met the burden of establishing a prima facie case of obviousness. It is clear that, not only does each of Mirkin (843), Mirkin (143), Anstadt, Colbert, and Requicha individually fail to disclose all of the elements of the claims of the claimed invention, particularly, a scanning probe microscope tip having an adhesion promoter thereon and coated with a layer of chemically-synthesized generally spherical nanoparticles affixed to the tip, as discussed above, but also, a combination of Mirkin (843), Mirkin (143), Anstadt, Colbert, and Requicha, fails to disclose these elements as well. The unique elements of the claimed invention are clearly an advance over the prior art.

The Federal Circuit also went on to state:

The mere fact that the prior art may be modified in the manner suggested by the Examiner does not make the modification obvious unless the prior art suggested the

desirability of the modification. . . . Here the Examiner relied upon hindsight to arrive at the determination of obviousness. It is impermissible to use the claimed invention as an instruction manual or "template" to piece together the teachings of the prior art so that the claimed invention is rendered obvious. This court has previously stated that one cannot use hindsight reconstruction to pick and choose among isolated disclosures in the prior art to deprecate the claimed invention. Fritch at 1784-85, citing In re Gordon, 221 U.S.P.Q. 1125, 1127 (Fed. Cir. 1984).

Here, there is no suggestion that Mirkin (843), Mirkin (143), Anstadt, Colbert, and Requicha alone or in combination with one another, teaches a structure and method containing all of the limitations of the claimed invention. Consequently, there is absent the "suggestion" or "objective teaching" that would have to be made before there could be established the legally requisite "prima facie case of obviousness."

Additionally, clearly the invention is part of a crowded art field. As such, given the crowdedness of the art, the novel aspects of the invention should be regarded as a significant step forward in the constant development of this technical art field.

Indeed, Mirkin (843) merely discloses a method of nanolithography utilizing a scanning probe microscope tip to pattern a substrate passivated with a resist using a patterning compound. Contrary to the assertion in the Office Action, the patterning compound is a molecular compound transferred to a substrate, not a nanoparticle affixed to a scanning probe microscope tip. Accordingly, Mirkin (843) is structurally and functionally distinct and not equivalent to the claimed invention. (See Mirkin at Abstract; and Paragraphs [0001] and [0006]).

Applicants respectfully submit that the Examiner misinterprets Mirkin (843) in the Office Action. Although the Office Action cites paragraphs [0015], [0053], and [0093] as evidence of Applicants' claimed invention, none of these paragraphs, or for that matter any other paragraph in Mirkin (843), appear to discuss any "nanoparticle containing additives." Instead, Mirkin (843)

discusses many different possible patterning compounds, however these patterning compounds are all different types of molecules; not nanoparticles as claimed by Applicant. (See Office Action, Page 2-3, Section 3; and Mirkin (843). Paragraphs [0055]-[0074]).

Indeed, Mirkin (843) does not disclose a method for “coating a probe tip with a patterning compound.” Instead, Mirkin (843) specifically describes: “The method comprising...coating the tip with a solution of the patterning compound, and contacting the coated tip with the substrate so that the compound is applied to the substrate so as to produce a desired pattern.” Accordingly, it is clear that the patterning compound is never applied to the tip as the patterning compound remains in solution when coating the tip. Further, Mirkin (843) teaches away from having the patterning compound coating the tip as Mirkin (843) is focused on transferring the patterning compound to the substrate. Thus, the Mirkin (843) structure is directly counter to Applicants’ invention, in which nanoparticles are affixed to the tip. (See Mirkin [0015]).

In addition, Applicants traverse the assertion that Mirkin (843) discloses or teaches “a variety of patterning compounds that include nanoparticles.” Instead, as noted above, paragraphs [0055]-[0074] disclose a long list of possible patterning compounds, which are all molecular compounds, not nanoparticles. In particular, paragraph [0081] describes a method by which force can be applied between tip and sample – in this case, a method for applying a magnetic force. Mirkin (843) states that this can be done “with a magnetic material located behind the tip by a current-carrying coil.” However, there is no disclosure or suggestion of nanoparticles in relation to this method, or in fact of anything attached to a tip. Further, paragraph [0089] describes patterning of arrays with arrays of biological materials. Again, Mirkin (843) does not

disclose or suggest any nanoparticles in this paragraph or in any paragraph. Furthermore, this paragraph does not disclose attaching anything to a tip. (See Mirkin (843), Paragraphs [0055]-[0074], [0081], and [0089]).

Please note, although Mirkin (843) appears to describe the use of 13 and 20nm nanoparticles, Mirkin's use of these nanoparticles is structurally unrelated to Applicants' invention as these nanoparticles are attached to the substrate, whereas Applicants disclose that the nanoparticles are affixed to the tip.

In particular, paragraph [0109] describes "a structure-forming compound comprising oligonucleotide strand B attached to 13nm nanoparticles was applied as described above." Paragraph [0105] describes a "Structure-forming compound B was applied to the substrate by immersing the substrate in a solution of the compound for an hour at room temperature so that the oligonucleotide strand B hybridized to oligonucleotide C." However, as indicated above, these disclosures involve attaching the 13nm nanoparticles (with oligonucleotide strand B attached) to the substrate, and not to a tip. Indeed, the essence of Mirkin's invention is that structures are attached to substrates, and not the tips used to pattern the substrates. Similarly, paragraph [0114] is a different example involving 20nm gold nanoparticles, however again these nanoparticles are affixed to oligonucleotide strand D and then attached to a substrate, and not a tip. [0114] notes "oligonucleotide strand D attached to 20nm gold nanoparticles was prepared and applied to the substrate as described in Example 1...."

Accordingly, Mirkin (843) does not teach nanoparticles being affixed to a tip, let alone, an outer coating layer of a nanoparticle. Therefore, Mirkin (843) does not disclose, teach or suggest, including each of the nanoparticles includes an outer coating layer encapsulating each

nanoparticle. Mirkin (212) is also deficient.

In contrast, Figures 27A and 27B of Mirkin (212) merely disclose “dip pen” lithography using a scanning probe microscope where a tip is coated with a patterning compound comprised of molecular compounds and delivered from the tip to a substrate. Although Mirkin (212) is primarily focused on using molecular compounds as a patterning compound, Mirkin (212) does suggest a single particle array formed on 300nm or 700 nm dots. However, Mirkin (212) like Mirkin (843) discloses that the patterning compound is easily removable from the tip surface with a suitable solvent, and thus is not affixed to the tip like Applicants’ invention. (See Office Action, Page 3, Paragraph 3; Mirkin (212) at Abstract; Page 4, Paragraphs [0049] and [0054]; Page 24, Paragraph [0209]; and Figures 27A and 27B).

Indeed, Mirkin (212) appears to suggest coating a tip of the scanning probe microscope, not a coating over each single particle of the array. Therefore, Mirkin (212) does not disclose, teach or suggest, including each of the nanoparticles includes an outer coating layer encapsulating each nanoparticle as claimed by Applicants.

In comparison, Applicants’ claimed invention includes a scanning probe microscope tip 1 where nanoparticles 2 are affixed to the scanning probe microscope tip 1, and each nanoparticle is encapsulated by an outer coating layer 3. The nanoparticles 2, for example, as recited in claim 31, may include cobalt nanoparticles. Further, the outer coating layer 3, for example, as recited in claim 32, may include a single molecular layer of oleic acid. (See Application, Page 7, line 20-Page 8, line 1).

As discussed above, Mirkin (843) only discloses molecular compounds and Mirkin (212) primarily discloses molecular compounds and suggests single particles as patterning compounds,

though neither reference discloses or suggests any outer coating layer encapsulating the molecular compounds or the single particles. Accordingly, the claimed invention provides a structure, which improves the spatial resolution of a scanning probe microscope when compared with either of the conventional Mirkin inventions.

Thus, Applicants traverse the assertion that Mirkin (843) and Mirkin (212) teach Applicants' claimed invention. For at least the reasons outlined above, Applicants respectfully submit that neither Mirkin (843) nor Mirkin (212), alone or in combination, disclose, teach or suggest, including each of the nanoparticles includes an outer coating layer encapsulating each nanoparticle.

Indeed, the Applicants agree with the Examiner that neither Mirkin (843) nor Mirkin (212), disclose the use of adhesion layers and annealing, as well as the above claimed feature, and thus these references are deficient in that they do not disclose Applicants' claimed invention. (See Office Action, Page 4, lines 1-9). Colbert is also deficient.

In contrast, Colbert merely discloses macroscopically manipulable nanoscale devices made from nanotube assemblies. As described in highly specific detail in the previous Amendment, Applicants clearly describe that Colbert is focused on using molecular nanotubes to fabricate devices that enable interaction between macroscopic systems and individual objects having nanometer dimension without disclosing or suggesting the use of nanoparticles like Applicants' claimed invention.

For emphasis, as indicated in Colbert, "in a preferred form this device comprises a nanotube probe tip assembly made up of one or more single-wall and/or multi-wall nanotubes." Accordingly, Colbert teaches away from using the smaller nanoparticles. Indeed, Applicants

agree with the Examiner that Colbert as well as Mirkin (843) and Mirkin (212) fail to teach the use of spherical nanoparticles. Clearly, Colbert does not disclose or teach the use of any nanoparticles, let alone, spherical nanoparticles or a coating encapsulating nanoparticles. Therefore, Colbert does not teach or suggest including each of the nanoparticles includes an outer coating layer encapsulating each nanoparticle. (See Office Action, Page 4, Section 5; Colbert at Abstract; Page 1, Paragraph [0007], [0012]; and Page 2, Paragraph [0034]; and Page 10, Paragraph [0115]).

Applicants' claimed invention, as discussed above, includes nanoparticles 2 encapsulated with an outer coating layer 3, whereas Colbert only discloses nanotubes, not nanoparticles, let alone, nanoparticles encapsulated with an outer coating layer. Thus, Applicants traverse the assertion that Colbert teaches Applicants' invention.

For at least the reasons outlined above, Applicants respectfully submit that none of Mirkin (843), Mirkin (212) nor Colbert, alone or in combination, disclose, teach or suggest, including each of the nanoparticles includes an outer coating layer encapsulating each nanoparticle.

Indeed, the Applicants agree with the Examiner that none of Mirkin (843), Mirkin (212), nor Colbert "teach the use of spherical nanoparticles," as claimed, for example, in claims 30-36, and thus these references are deficient in that they do not disclose Applicant's claimed invention. (See Office Action, Page 4, Section 5, Paragraph 2). Requicha is also deficient.

In contrast, Figures 2A-2F of Requicha merely disclose a method, and related structure, for fabricating a nanoscale object including defining a sequence of nanolayers that represent the nanoscale object, constructing a current nanolayer on a first surface, and depositing a sacrificial

layer to cover the first surface but not the nanolayer. As described in highly specific detail in the previous Amendment, and in response to the assertions in this Office Action, Applicants clearly assert that Requicha is focused on using nanolayers where the nanolayers may be comprised of gold spherical nanoparticles with diameters between 5 and 30 nm. Although, Requicha discloses gold nanoparticles, the gold nanoparticles are cross linked to form the nanolayers, and thus the resultant structure are nanolayers, not individual nanoparticles affixed to a tip of a scanning probe microscope like the claimed invention. Accordingly, Requicha teaches away from forming structures with individual nanoparticles.

Indeed, Requicha may teach using nanoparticles as intermediate structures to form nanolayers, but does not disclose or teach the use of nanoparticles as the resultant structure, let alone, nanoparticles where each nanoparticle is encapsulated by an outer coating layer. Therefore, Requicha does not teach or suggest including each of the nanoparticles includes an outer coating layer encapsulating each nanoparticle. (See Office Action, Page 4, Section 5; Requicha at Abstract; Column 1, lines 10-25; Column 2, lines 30-50; Column 3, lines 35-47; and Figures 2A-2F).

For emphasis, Applicants' invention, as discussed above, includes nanoparticles 2 encapsulated with an outer coating layer 3, whereas Requicha only discloses nanolayers formed from nanoparticles. Since Requicha is deficient, Requicha also does not disclose or teach that the nanoparticles comprise cobalt nanoparticles, for example, as recited in claim 31.

For at least the reasons outlined above, Applicants respectfully submit that none of Mirkin (843), Mirkin (212), Colbert nor Requicha, alone or in combination, disclose, teach or suggest, including each of the nanoparticles includes an outer coating layer encapsulating each

nanoparticle.

In view of the foregoing, the Applicants respectfully submit that the collective cited prior art do not teach or suggest the features defined by amended independent claims 1, 10, 24-28, and 37 and as such, claims 1, 10, 24-28, and 37 are patentable over Mirkin (843), Mirkin (143), Anstadt, Colbert, and Requicha alone or in combination with one another. Further, dependent claims 2-9, 11-18, 20-23, 29, and 31-32 are similarly patentable over Mirkin (843), Mirkin (143), Anstadt, Colbert, and Requicha alone or in combination with one another, not only by virtue of their dependency from patentable independent claims, respectively, but also by virtue of the additional features of the invention they define. Thus, the Applicants respectfully request that these rejections be reconsidered and withdrawn.

Moreover, the Applicants note that all claims are properly supported in the specification and accompanying drawings, and no new matter is being added. In view of the foregoing, the Examiner is respectfully requested to reconsider and withdraw the rejections.

III. Formal Matters and Conclusion

In view of the foregoing, the Applicants submit that claims 1-18, 20-29, 31-32, and 37, all the claims presently pending in the application, are patentably distinct from the prior art of record and are in condition for allowance. Furthermore, no new matter is presented. The Examiner is respectfully requested to pass the above application to issue at the earliest possible time.

Should the Examiner find the application to be other than in condition for allowance, the Examiner is requested to contact the undersigned at the local telephone number listed below to discuss any other changes deemed necessary. Please charge any deficiencies and credit any

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overpayments to Attorney's Deposit Account Number 50-0510.

Respectfully submitted,

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